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MODERN MOTORING or THE AGE of GASOLINE

ALFRED ARMSTRONG CROCKER

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OR

THE AGE OF GASOLINE

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ALFRED ARMSTRONG CROCKER

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MODERN MOTORING, OR THE AGE OF GASOLINE

CHAPTER I.

TECHNICAL POINTS OF THE MOTOR.

In presenting the motor car subject it is a question whether to present the technical side first, then the popularity side, or vice versa. It can readily be noticed by the adept from what point of view or combined points the novice approaches the game. However, there is a technical side, in fact, a very technical side, to the subject, and it is my aim and intention to make plain the salient points of same, so that the reader will have full knowledge both

theoretically as well as afterward practically. There are so many who are really interested in the sport, who notice the wheels go round and catch the image of the limousine and touring car, who feel unacquainted with the principles which actuate the motor, that they are drawn with curiosity, then with absorbing interest to a knowledge of the mystery.

These technical points are simple yet necessary, and with no extra amount of application may be readily understood and aptly applied by the public in general. Motoring is already as widely diffused as to knowledge as is music, and possibly if it keeps up its rapid pace will be as popularly understood as horsemanship and possibly more so.

The abstruse technical points of the motor and chassis (chassis means running gear and engine, in other words, auto in the nude), are adequately treated of in special books on the subject. See "The Gasoline Automobile," Albert L. Clough; "The Horseless Age;" "Self-Propelled Vehicles," James E. Homans, A. M., Theo. Audel & Co.; "The Operation, Care and Repair of Automobiles." These books are purely technical and are of great value to the motorist, being devoted to the algebra of motoring.

The four-cylinder engine of about 30 H. P. is the standard engine of manufacture and use. There is no lapping of the power impulses in the four-cylinder type, but each cylinder takes up the power stroke with such con-

stant and uniform continuity that the torque is practically constant. By this I mean that the power stroke in one cylinder starts as soon as the power stroke in one of the other cylinders ends. The four-cylinder engine is the medium of all the various merits and demerits of construction and does the work. They may eventually put in a six where they formerly supplied a four, but all users of the four will remember its many advantages.

The phases through which each cylinder passes are: intake, compression, power, exhaust. On the intake stroke downward the intake valve is open and at near lower dead center it closes and the piston coming up compresses the gasoline mixture drawn in from the carburetor on the intake

stroke. At the top dead center at end of compression stroke (a little before in fast running under load) the gas is fired by the ignition apparatus through the spark plug and the power stroke ensues, the piston passing downward under impulse of the expanding gases to lower dead center again. Then follows the exhaust stroke, the piston coming up with the exhaust valve open. Near top dead center it closes and immediately the intake stroke follows. During compression and power strokes both intake and exhaust valves are closed. These cycles and phases of the engine follow in quick succession. In a four-cylinder engine each of the four cylinders is placed on one of these four phases so that each cylinder represents at any time some one

of the above phases, and the whole engine always has one cylinder on the power, one on the intake, one on the compression, and one on the exhaust. This accounts for the four cylinders being the most used.

The actuating influences to the metal parts of the engine (which, as everyone knows, consists of pistons and cylinders with crankshaft) are the ignition apparatus supplying the electric current, the carburetor supplying the mixture of air and gasoline, the oiling system providing the lubrication, and the water system maintaining the cooling processes to the cylinder walls. The magneto of the ignition system provides the current to spark the mixture produced by the carburetor, and the water system keeps down the temperature of the engine within

working limits, while the lubricating system does the same through eliminating friction and producing easy running. So these four actuating influences provide the electricity, gasoline mixture, water and lubricating oil for the engine.

The ignition apparatus is composed of spark plugs with dash coil, magneto and storage battery. The early cars did not have a magneto, and the motorist of those early days was somewhat in the same position as the driver of an electric car is today. The auto would run as long as the battery lasted. The magneto has shifted the distance to the size of the gasoline tank. The magneto is constant and will spark the gasoline mixture as long as there is gasoline to supply the mixture.

Therefore at present it is the gasoline capacity of the car that determines how far the car can be run and not the battery capacity. The battery now supplied on cars is used only for starting the ignition, and as soon as the engine starts the current is switched so that the magneto current does the work and the battery is saved.

The timer is a rotating switch which constantly turns the current into the spark plug on the proper cylinder which is to be on the power stroke. The timer is so timed as to producing the spark in the spark plug that it produces the ignition spark at the very instant the piston is ready to make the power stroke.

The coil box contains the coils which are electrically necessary for the production of large sparks

between the points of the spark plug.

The magneto is a current generator. It is somewhat similar to a dynamo of small dimensions. The difference between a magneto and a dynamo, although the delivered current is the same, is that the field current is differently produced. A dynamo has a shunt or direct-series current-induced magnetic field. The magneto has a permanent magnetic field, produced by permanent magnets. With the magneto came the permanency of the auto and it passed from the toylike apparatus depending upon the caprices of a set of dry cells, connected in series, to a wonderful concentration of automatic power.

Electrically speaking, the batteries used now furnish a pri-

mary interrupted current; the secondary current obtained by induction is the ignition current. The automobile books speak of these currents as low-tension and high-tension respectively. The secondary or high-tension current is the distributed ignition current. The induction takes place in the coil box on the dash.

The engine governor is direct connected to the throttle, as the gasoline mixture has so much more to do with speed of the engine than does the spark. It is left to the driver to govern the spark. The throttle, however, is entirely governed by the governor on the engine, and insures uniform operation and conforms the engine activity to the work automatically.

The batteries for the ignition system should be storage batteries of 60 to 80 ampere hours. These batteries cost the factory more to install than to supply dry cells. The storage battery costs the owner less to recharge than to buy new dry cells. The recharge of a storage battery costs fifty cents, while the replacement of six dry cells is one dollar and fifty cents. The storage lasts longer than the dry cells and is more constant.

The carburetor is the device in which the liquid gasoline is vaporized, mixed with sufficient air to form an explosive mixture, and from which this mixture is drawn or sucked by the intake stroke of the engine. The amount of mixture drawn in is governed by the throttle. The throttle valve is just

above the mixing chamber of the carburetor and has foot-connection lever, also driving-wheel lever. There are three salient parts to a carburetor, viz.: float-feed, mixing chamber, and auxiliary air valve. The mixing chamber is where the gasoline and air meet to be mixed. The auxiliary air valve is governed by lever on dash, so that proper results can be obtained under all conditions of the atmosphere. The valve is made to open less when the atmosphere is cold and damp and made to open more when the atmosphere is warm and dry. These changes in the atmosphere would very materially change the results obtained in the engine if it were not for this ready adjustment of the carburetor to the requirements of the mix. There are

two methods in vogue as to carburetion: variable amount of gasoline and constant amount of air; variable amount of air and constant amount of gasoline. In one, with the primer, you prime the gasoline. In the other, with the auxiliary valve, you prime the air. To increase the gasoline is equivalent to lessening the amount of air; both enrich the mixture.

The water system consists of the radiator, the driven water pump, and water jackets around the cylinders. The system will hold about five gallons of water and the pump keeps the water in circulation, drawing it from the bottom of the radiator, forcing it through the water jackets and thence to top of radiator. The water is cooled in the radiator.

One can perceptibly notice the difference in temperature between the top and bottom of radiator by placing the hand on same. The pump consists of three or four paddles moving with spiral effect in an inclosed space, thus forcing the water between each paddle forward. The thermo-syphon or gravity plan is used on some cars, but is not positive in results. This method does not have a pump to keep the water in circulation. It is important that the radiator be kept filled with water. In the winter time anti-freezing solutions are used in cold climates, but it is hardly necessary in the climate in the vicinity of Cincinnati. When the engine is perfectly cold and has not run for a time, or when there is no heat in the engine from its being

run, it will stand 32° Fahrenheit; when the engine is running, it will stand 10° to 20° below zero without anti-freezing mixture; so that if the garage is warm enough to keep the car at 32° or above, and the temperature outside not lower than 10° to 20° below zero, an anti-freezing mixture is unnecessary. Common salt dissolved in the water before running it into the radiator will make an anti-freezing mixture; 10% alcohol and 90% water will make another. Some of the formulas have glycerine in them. Plain water is a very good mixture and when used within the limit of temperatures above stated does not freeze while the engine is running.

The oiling system is important and should consist of splash with

draw-off levelers and automatic pump with sight-feeds. The splash is produced by a level of oil in the crank-case into which the crank-shaft dips or splashes. While the splash alone will take care of an engine, the average engine needs renewal of oil to replace the small amount constantly consumed. This consumption of oil from the crank-case is replaced by the automatic pump from an oil supply. The oil should not be allowed to get above the stop-faucet levelers. The automatic pump can be relied on not to let it get below the proper level. Too much oil in the crank-case produces a smoky exhaust. Many cities have passed ordinances not permitting autos to smoke. It can easily be prevented by drawing off the excess of oil in the

crank-case. Some of the old-style cars have extensive sight-feed apparatus on the dash, but much simpler systems are now used which are less complicated and equally, if not more, efficient. The oiling system can do its part—the balance rests with the oil. Use a good quality.

The dry multiple-disk clutch is the only clutch now used and is practically perfection. It drops the engine instantly when opened and permits easy shifts; also allows the intermediate limb between clutch and gears to come promptly to rest, thus permitting engagement of gears without growling.

There are three general types of the Seldon motor—I, L, and T. The T motor has inlet valves on one side and outlet valves on the

other side. The L motor has both inlet and outlet valves on the same side. The I motor has both inlet and outlet valves directly in top of cylinder. The T form of engine is most used. Some of the foreign cars and a few American cars use the L type. The I type is moderately used. The Knight and Mead engines are two types of valveless engines and have interesting features worthy of notice. The Knight motor has automatic opening apertures without springs. There is no snap of a spring in closing. It permits of noiseless results with less minute manufacture of small parts than does the I, T, or L spring type. These latter, however, now called "poppets," when accurately made and adjusted, make an equally

noiseless engine. The Mead has rotary valves.

The diagnosis of an engine trouble is particularly interesting and gives opportunities for analysis. So many engine disturbances manifest themselves in the clutch that at first one naturally thinks that the clutch is out of order. However, one afterward finds out that the trouble is in the ignition apparatus or carburetor. Following is a short list of some of the common engine faults and hints as to their diagnosis.

Lack of Power.

Ignition weak, current jumping through possible crack in spark plug porcelain. Spark plugs sooted.

ENGINE STOPS.

Exhaust valve not closing tight. Magneto circuit breaker worn. Gasoline poor quality. Out of gasoline. Magneto circuit breaker not working. Magneto circuit grounded. Mixture too rich. Too much air in the mixture. Ignition ground wire broken.

ENGINE RUNS AFTER IGNITION TURNED OFF.

Cylinders overheated. Water system out of order. Spark has been retarded while running.

KNOCKING IN ENGINE.

Cylinders overheated. Spark too far advanced, going slow. Running too slow in high for power required. Connecting rod loose. Water system short of

water. Spark too far retarded, going fast.

Skipping or Catching in the Clutch.

Ignition skipping in one cylinder at least. Spark plug sooted. Porcelain cracked. Magneto needs adjusting. Mixture too rich. Mixture too weak. Ignition weak. Valves need grinding. Timer slipped on rotary axis. Valves out of time. One cylinder getting more oil than it should. Piston rings worn. Oil level in crank-case too high. Water in the gasoline.

Smoking Exhaust.

Too much oil in crank-case (blue smoke). Mixture too rich (black smoke).

BACK-FIRE INTO CARBURETOR.

Ignition too weak. Battery weak. Mixture too rich. Engine overheated. Water system short of water.

CHAPTER II.

GASOLINE.

Gasoline is now produced in greater quantities than ever before, and threatens to surpass the beverage, beer, in yearly production.

Gasoline is a limpid, colorless liquid of specific gravity 72° to 68° Baumé, which corresponds to .695 to .709 standard specific gravity. It is distilled from crude petroleum oil and is only one of the many products recovered from the crude oil. When gasoline is the object of the distillation the other products are called by-products. As used in motor cars,

the gasoline goes into the mixing chamber of the carburetor from the float-feed drop by drop, and is instantly vaporized by the warmth of the walls of the mixing chamber, which are in most cars hot-water jacketed, and is there mixed with air drawn in by the intake stroke of the piston. It is thus evident that the higher the grade of gasoline used the easier and with less uncertainty this vaporization and mixing with air takes place. The temperature of the incoming air has also considerable to do with the facility with which this mixture takes place, grade of gasoline being the same. A higher grade of oil used in cold weather gives better results than continuing on the medium grade same as used in warm weather. A higher grade of oil

makes up for a colder atmosphere and a warmer atmosphere makes up or compensates for a lower grade of oil. To gauge the quality of gasoline so as to be sure you are using the grade you intend, take a Baumé gasoline hydrometer and thermometer. Take a reading from the hydrometer scale and thermometer scale after allowing the instrument to float in a sample drawn off from the gasoline tank. The temperature correction is two degrees Baumé for every ten degrees Fahrenheit. If the temperature of the sample is above sixty degrees Fahrenheit, deduct the correction of two degrees Baumé. If the temperature of the sample is below the sixty degrees Fahrenheit, add the correction of two degrees Baumé. This correction for temperature

is two degrees Baumé for every ten degrees of temperature; as above stated, this means that if the temperature difference from sixty degrees Fahrenheit is five degrees the correction is one degree Baumé. The reason for the addition or subtraction to the hydrometer reading for temperature of reading is that the Baumé scale is calculated for gasoline at sixty degrees Fahrenheit. Temperature above sixty rarefies, so deduct the correction; and temperature below sixty condenses, so add the correction. This statement would be just reversed if we were considering specific gravity according to the standard decimal system with water as one and not using Baumé. The following table will elucidate further this problem.

BAUMÉ'S DEGREES	SPECIFIC GRAVITY
64	.724
65	.720
66	.717
67	.713
68	.709
69	.706
70	.702
71	.699
72	.695
73	.692
74	.689
75	.685
76	.682

Increase of temperature makes less dense—lessens specific gravity — increases Baumé degrees. It will be noticed that .702 specific gravity is equivalent to 70 Baumé, but when we speak of 70-degree gasoline 70 Baumé is meant. Considerable confusion is experienced about the specific gravity of gasoline until the above table

is comprehended. As Baumé scale runs up, the lighter the liquid; as the standard specific gravity runs down, the lighter the liquid. It is interesting to be able to make your own tests. It adds to the interest one can take when surveying the running of the garage.

Gasoline should be properly stored. The Bowser tanks and pumps are indispensable. They are better than insurance. It is needless to say that gasoline should be very carefully handled. Its only use about a car should be to run it. Its use as a cleanser should be avoided. Glycerine soap will do that class of work.

The gasoline tank on a car is generally under the front seat, although some cars have them elsewhere. Water in gasoline

(being heavier than gasoline) will settle in globules to the bottom, and for this reason a pocket is made in bottom of tank, under which a draw-off valve is placed, so that the gasoline can be cut off and the pocket drained of whatever water has accumulated there. This feature of the gasoline should be carefully watched.

Before explaining the progress of the gasoline vapor or mixture, as it is called, going motorward, let us describe how the gasoline is carried on the car. I have stated that the tank is generally under the front seat and this is the most satisfactory point from which to conduct it by gravity to the carburetor float-feed. A constant flow can be maintained to the curburetor at all inclinations of the car, whether up or down

hill. This method obviates air pressure, together with its attendant difficulties, and makes unnecessary the automatic pressure readjuster from by-pass of the exhaust. The simpler method is by far the better.

From the carburetor the mixture goes to the cylinders and is exploded on the power strokes, thence to the muffler on the exhaust, then into the air. Muffler cut-outs are put on to take advantage of the free exhaust into air. The muffler is some opposition to exhaust and reduces the power to a slight extent, but the disagreeable noise of direct exhaust is more of a disadvantage than the advantage of the power gained thereby. Power gained through deafening noise is less consideration than quiet, though

less power. The gain in power does not compensate for the loss of silence.

The grade of gasoline mostly used is the medium grade which sells for about twelve dollars for one hundred gallons, and about sixty-eight degrees Baumé. This gasoline will run in all degrees of cold and heat. If the carburetor is not hot-water jacketed (another point of economy in operation) it is generally necessary to use the higher grade, seventy-two degree Baumé, gasoline.

CHAPTER III.

Driving as a Profession.

The motor has given an opportunity to a large number of men, not only as manufacturers of all the different parts connected with the production of a car, but also work for men to care for and operate them after they are in use by the owners. Our everyday schooling has sufficient mathematics and other exact sciences in the curriculum to furnish adequate basis for an interest in the scientifically constructed automobile. We find a large number of people attracted to this interest because it is exact and they feel that they can understand it.

Many people who do not intuitively understand horses or animals are originally capable as motorists and are resourceful for any emergency which the motor car presents. Fine driving is certainly appreciated. It has quality the same as piano-playing or horsemanship.

Care of the car after the day's work is important. It should be washed at once when put up after being out in rain or mud. Run the mud off with water before it dries, if possible. The oil should be leveled down in the crank-case, water kept in the radiator, and oil in the oiler, not to mention gasoline in the gasoline tank. These may run low without your knowing it.

Workshops in the garages are becoming unnecessary, there be-

ing so little repairs to be done on a good car. There are many cars that have never had a repair. A garage should be lighted by electricity and heated by steam or hot-water system; preferably by system extension from some adjacent house or building, so that no fire is in the garage. A garage should have a gasoline storage tank and pump outfit; also a lubricating-oil room. There should be adequate water supply and good cement drain floor to run cars on for washing and polishing. There should be a large door, or two doors, for the cars to go through, in and out. The garage should be near the house, in rear, and should be under direct supervision of the owner. It is extremely inconvenient to have the garage far away. Those who

have used the public garage eventually get a garage of their own, as they can give the cars so much more of their personal attention. The owner who is actually interested in the motor is as interested in it when it is standing still as when it is running on the road, and therefore wants his own garage. When he builds, he places the garage near his house, so that the cars will be conveniently handy at all times. During rainy and cold weather this convenience is greatly appreciated. One of the best additions that could be made to the already-well-planned apartment buildings is a garage house on same lot, so that apartment tenants could house their own cars in private garage. This is one of the modern demands due to the motor car.

Driving as a profession is a good class of work and calls for superior character and considerable education.

Driving may be divided into three classes: Suburban driving, city shopping, touring; and these each again into two classes, depending on the weather, either fair-weather driving or rainy and snowy-weather driving. There is some work attached to both, but more to the rainy-weather. Professional driving should be based on a technical knowledge of the subject, such as afforded by the Y. M. C. A. Automobile School. As its diploma means proficiency in the theory and practice of the art, its value as to obtaining a position is recognized.

There are only three ways to learn how to drive. First, buy a

car and be taught on your own car by the motor car company expert who sells the car. Second, to find someone who has a car and who will, after finding out that you understand the theory of the car, permit you to drive or show you how. This form of learning is of two kinds, the owner who teaches you on his car may be your social friend and be interested in your progress as a driver, or he may be your prospective employer and be interested in your learning to drive so that he can eventually employ you as his driver. The third method of learning is to attend the Y. M. C. A. Automobile School, which maintains a school of theory and practice in an up-to-date garage. The laboratory work ranges all the way from

washing the cars to adjusting mechanism, diagnosing faults, and making repairs.

All chauffeurs are required by law to register each year by application to the Secretary of State and to send in a fee of two dollars. They receive therefore a badge which they wear so that they can easily show it if necessary should any question as to their right to drive a car arise. Chauffeurs are required to wear the badges which are issued by the Department of State Automobile Department. Badges are not transferable. In addition to the badge, owners must give chauffeurs written authority to drive their cars, which police can demand if necessary.

The chauffeur feels proud of his position and, when accomplished,

he is in line for all sorts of touring down east and abroad. After one year of driving in all the different seasons and circumstances which arise in traffic and country runs, one is a much better manager of a car and feels much more competent than at the beginning of the experience.

A great deal of skill can be displayed in auto driving. The car can do a great deal, but it needs a performer to show others what it can do. It is like a fine piano which alone can not give to an audience the symphony that it contains. Likewise with the motor car, it takes a skilled performer to develop its perfection of locomotion.

CHAPTER IV.

DRIVING.

Driving by the spark is a fine point to which, at the start, one pays little attention, but to which later one can apply study and learn to bring out the maximum power of the engine, thus carrying out the designs of the manufacturer as to how the car should be used engine-wise.

For starting, retard the spark; for idle running where full power is not needed, medium spark; for full-running developing power use full advanced spark. These are the general rules. Engine control is one of the fine points of driving and distinguishes the nov-

ice and mechanical driver from the expert and mental driver. The continuity of motion and the smoothness of shift, if any is necessary, are only possible by engine control. When the spark is retarded it is of advantage in starting by the crank, as it is then impossible for the engine to kick back. Failure to retard the spark for starting is to invite a kick. For power development, however, the distance through which the explosion on the piston can operate due to retarded spark is too short, so that the spark must be advanced for power. This is synonymous with raising the point at which the spark is produced. The maximum point, of course, is top dead center. Any engine will knock if the spark is too far advanced under power development

for the speed of the motor. The remedy is to retard same until the knock subsides. A knock is recognized by a sharp metallic click in new cars, in older cars it is more of a thud or heavy sound or pound. It is not a dangerous symptom, but merely an indication to the driver to either change gears or retard the spark. The change-spark lever is generally on the left of the steering wheel and is operated by the thumb of the left hand. Some drivers get in the habit of negotiating a slowing up by opening up the clutch, putting on the brake and allowing the engine to run on. But the better and more scientific method is to close throttle, advance spark, then retard spark and use running foot-brake. When engine is thus brought down to slower run-

ning the opening up of clutch does not race the engine at all.

The clutch is a very important element in driving and although, at first when beginning to drive, one does not realize how much can be overcome by the proper use of the clutch, it afterwards becomes the means of successfully negotiating all the slippery pavements and abrupt turns with no skidding, without chains. Opening the clutch on a bump in the road saves the communication of the jar to the engine. Chains are essential and necessary, but can be dispensed with except on ice and snow. It is best to have them, however; they are a safeguard and a preventative. Do not allow the chains to remain on if the car is to stand a long time in the garage. The cross chains wear the

rubber at the places where the continued pressure on the floor is maintained.

The public have a misconception of the gears on a car. It is so often that "high gear" has been used synonymous with "high speed," especially in yellow journalism. In everyday parlance the two expressions mean the same. The fact of the matter is that most all the slow driving, as well as all the fast driving, is done in the high gear. The manufacturer has spent considerable time and money adapting the auto engine to the auto carriage so that the automobile could be driven slow in high gear. This feature is especially desired to eliminate gear shifting. The high gear is a gear or direct drive of the engine which gives the engine the fewest

revolutions to one revolution of the rear-driven wheels. Thus there is the least power as regards overcoming the inertia of the car in the high gear. This makes it necessary to have low, intermediate, and high (or direct) gears to permit the car to negotiate all conditions of travel which it will encounter. Invariably start the car in low gear, then pass to intermediate, then to high. In high you can slow back to very slow speed and remain in high. However, if a rapid pick-up is necessary a shift to intermediate must be made. Make it an invariable rule to always go into intermediate before crossing railroad tracks. The reason for this is that tracks are always crossed slowly and if in high, you are at the disadvantage of shifting to

intermediate right on the tracks if a train is coming and you need to drive off quickly. The nervousness of such shifts has caused engines to stall and accidents to happen. Since the advent of the self-starter (a device to crank the engine from the driving seat, by compressed air, sparked acetylene, or auxiliary electric motor), there is less danger of serious results. Demonstrators' talk about what a car will do in high does not apply to crossing railroad tracks. One is supposed to exercise some common sense and not feel mortified if the car will not do everything on the high gear. The talk about high gear is nonsense and is averse to an intelligent understanding of the subject by the public, and greatly influences the novice motorist to the extent that

he sometimes becomes dissatisfied with the car that will not do everything on earth on high. Very serious injury can be done to a motor if the knocking (produced when it ought to be in intermediate) is not avoided. To expect a motor to start on high gear is like hitching a race horse to a heavily loaded wagon and expecting it to run away with it. The three gears (or four, for some cars have four) are unavoidable and have their place, and necessary uses. The low gear allows many revolutions of the engine to one of the rear-driven wheels. This produces power and illustrates the formula for horsepower which is power through distance in time. The greater the distance, other factors in the equation being the same, the greater the horsepower

or number of foot-pounds per minute. The horsepower is 33,000 foot-pounds per minute. This shows, then, that as the revolutions of the engine are increased the distance through which the power moves per minute is increased, consequently the horsepower of the engine is increased. It is by the gears that the available horsepower of the engine is consumed in power to overcome inertia of the car in starting or on hills or liberated into speed on the level. The low gear delivers greater horsepower to the rear-driven wheels than the high gear does, revolutions per minute being the same. The power of the engine is directly proportional to the number of its revolutions. The number of revolutions being the only element in

the equation of power that changes value, to increase the power requires to increase the speed; therefore shift to lower gear, which allows the engine more revolutions to same speed of car on its wheels. A car going fast in high develops as great a power in its engine as going slower in intermediate. Some cars, as above mentioned, have four speeds. This fourth gear brings the car into the racer class, to which few auto owners wish to belong.

The tendency has been toward lower-power cars, say 30 H. P., and attention paid to flexibility and ease of operation, light handling, etc. Some cars, while quite attractive, are stiff and not easily handled in driving. The main objection to six-cylinder cars has

been that they are too long and cumbersome and do not permit of the light handling of smaller four-cylinder cars. Some six-cylinder cars, however, are made which are quite light handling considering they are sixes.

Flexibility of the motor is due to the proper proportion of combustion space to cylinder displacement together with proper timing of the operation of the inlet and exhaust valves.

In starting the car, retard the spark, open up the throttle, turn on the gasoline, see that the brake is set, and the gears are in neutral; then crank. The neglect to retard the spark causes the engine to fire on a cylinder just before top dead center is reached on a compression stroke and sometimes starts the engine backward.

This of course happens so suddenly and wrenches the hand so violently that a broken wrist results. A rule much advocated is to crank with the left hand and only pull up. To make it easier to crank there is an exhaust relief, a handled rod, which operates the relief cams. These hold the exhaust valves partially open during cranking, thus making it unnecessary to pull a compression.

In case the batteries are very low (run down), a back-fire will occur when cranking. This is because the mixture being so weakly sparked burns so slowly that it is still burning when the inlet valve opens on the intake stroke. To begin with, the spark is retarded in cranking; this sets the spark low down in the cylinder and the

power stroke is almost over when the gas is ignited. The current being very weak the ignition is incomplete and the mixture burns slower than it otherwise would, and is not finished burning by end of exhaust stroke which follows the power stroke. If the piston completely filled the top of the cylinder all the mixture products of combustion, etc., would be exhausted by the time the piston reached top dead center, but there is a space above top dead center known as the combustion space. In this space there always remains the volume of mixture not expelled on the exhaust. In the case of weak ignition the gas not exhausted remains in the combustion space burning and when the inlet valve opens for the intake stroke, which follows the exhaust

stroke, the incoming mixture is immediately fired and explodes back into the carburetor. There is always a volume of gas which is not expelled from the combustion space, but ordinarily, under proper sparking, the combustion space, after the exhaust stroke, is occupied by burnt and completely combusted gas, the flame of combustion having been spent. But when the ignition is weak and the gas burns slowly, the interval to closing of exhaust being shortened by retarded spark, the volume in the combustion space, after exhaust valve closes, is still burning, and the immediate opening of the inlet valve affords a combustible pathway to the carburetor. If the float-feed is in any way flooding, a fire will follow. The carburetor fires, how-

ever, are not at all dangerous unless the operator loses his head, and even then he is about as safe as to try to do anything, unless he does the right thing. The operator should turn off the gasoline at once so that no more will flow to the carburetor. The gasoline will burn until all the gasoline, about a cupful that was in the float-feed, is gone, when the fire will stop.

This phenomenon generally occurs when the car is standing still. A back-fire in cranking indicates weak spark from weak battery. Fire never occurs unless carburetor is overflooded. Of the two methods of obtaining the proper mixture—either priming the gasoline or priming the air — the foregoing explanation points to the latter as being bet-

ter. Constant (non-primable) gasoline and variable air reduces the chance of a fire in the carburetor to practically nothing. Inasmuch as travel running is done on magneto ignition, there is slight chance for back-fire while running, from above causes, as magneto ignition does not get weak. When batteries were used for road running and became weak, back-firing occurred while the car was in motion. A flooded carburetor under running back-fire is a different proposition. One can not easily reach to turn off the gasoline, and then the flame blows back to the woodwork. There are so few carburetor fires, however, that one hears very little of them, and many auto owners know nothing about them so far as actual experience goes.

The care of the manufacturer in properly designing the carburetor has saved them the necessity of having the experience. This feature of danger has entirely disappeared in the present advanced form of construction.

It is a good plan to use high-grade gasoline for a few months in the winter time for best engine results and performance, as without hot-water jacket (by-pass from top of cylinder water jacket direct through mixing-chamber jacket to water-pump), the air coming into the mixing chamber is too cold and does not become sufficiently warmed nor the gasoline sufficiently vaporized to make a good mixture. The hot-water jacket assists vaporization of the gasoline and amounts to torching it as the process is termed in

gasoline generators. The high grade of gasoline makes up for the discrepancy of heat, as it vaporizes at lower temperature, thus making the necessary mixture under less perfect conditions. Water jacket on carburetor is a money-saver to the motorist.

Here follow extracts from the Ohio laws governing automobiles:

Instructions to Owners, Chauffeurs, Manufacturers, and Dealers.

Every automobile owner in this state, shall file annually with the Secretary of State for each motor vehicle owned or acquired an application for registration, accompanied by a fee of $5.00 for each gasoline and steam and $3.00 for each electric motor vehicle. Two

number plates which must be conspicuously displayed on front and rear of motor vehicle are furnished by this department and are sent charges prepaid. These number plates must be attached parallel to the axles of the motor vehicle and must be kept free from dirt, grease or other substance liable to impair legibilty, and must not swing.

The certificate of registration can not in any event be transferred from one owner to another; neither can number plates be transferred from one motor vehicle to another. One of the objects of the Automobile Law is to insure greater safety to the public by fixing more definitely the identity and responsibility of persons operating such motor vehicles.

Owners who permit their number plates to pass into the hands of other persons render themselves liable to be made defendants in court proceedings, both civil and criminal. In prosecutions for violations of the speed law, or suits for damages, the identity of the party is frequently obtained through the number plates upon the offending motor vehicle. For their own protection in case of sale or transfer owners should remove their number plates and secure cancellation of their registration.

Only number plates furnished by this department may be used. Painting the number on the radiator does not comply with the law. The use of fictitious number plates, or number plates belonging to another motor vehicle or

one issued to any other person is punishable by a fine of from $25.00 to $300.00, or imprisonment from thirty to sixty days, or both. In case of loss or destruction of a number plate a duplicate will be furnished within a period of ten days for a fee of $1.00.

All applications must be made upon blanks furnished by this department and must be signed with ink by the applicant in person. These blanks may be obtained at the office of any county clerk or from any registered dealer in motor vehicles. The numbers are issued consecutively in the order in which the applications are received.

A list of registered motor vehicles with the names and addresses of the owners, is fur-

nished monthly to each county clerk, to be kept as a public record.

All certificates of registration expire on December 31st of the year in which they are issued.

Every chauffeur shall file annually an application for registration accompanied by a fee of $2.00. The department furnishes a certificate of registration and a chauffeur's badge which must be worn upon the clothing in a conspicuous place while operating any motor vehicle.

All testers, repairmen and mechanics in the employ of a manufacturer, dealer, or a garage, are required to register as chauffeurs. Any chauffeur permitting another person to wear his badge is subject to criminal prosecution.

No person shall drive any motor vehicle in the absence of the owner without such owner's written consent.

Manufacturers of and dealers in motor vehicles shall file annually an application for the registration of each gasoline, steam, electric or other make of motor vehicles and pay a fee of $10.00 for the registration of each make (steam, gasoline or electric) of motor vehicle. Certified copies of registration are furnished for a fee of $2.00 each and one duplicate set of number plates is furnished with each certified copy. If the manufacturer or dealer is a firm or corporation the application must be signed by someone authorized to represent same.

Every motor vehicle must be provided with adequate brakes

and a suitable bell, horn or other device for signalling, and shall, during the period from thirty minutes after sunset to thirty minutes before sunrise display three white lights, two on the front and one on the rear of each motor vehicle, the rays of which rear lamp shall shine upon and illuminate each and every part of the aforesaid distinctive number borne upon that part of the motor vehicle. The rays of the front lights shall be visible at least two hundred feet in the direction in which the motor vehicle is proceeding, and every motor vehicle shall also display, in addition, a red light on the rear.

All remittances to this department must be made by certified check, draft or post office money

order. Persons remitting in currency do so at their own risk unless sent by registered mail.

Very respectfully,

CHARLES H. GRAVES,
Secretary of State.

J. A. SHEARER,
Register of Automobiles.

CHAPTER V.

POPULARITY OF THE MOTOR.

The open car in summer and the limousine in winter are incomparable for shopping and the theater. Your mother and wife appreciate and make much use of the equipage and are thereby saved many steps, and, especially in winter, exposure to inclement weather. It is by far the pleasanter to be driven, so that one can converse and get in and out in shopping. Ladies do drive, however, to a considerable extent, especially suburban driving, when out for a spin or visiting. The electric is especially a favorite with and adapted to ladies

driving, it being smooth-running, noiseless, inclosed, and of moderate speed. The sport of motoring, however, does not enter into the interest in electrics so much as into the gasoline car, utility and moderate transportation being the attraction.

The limousine is preëminently the ladies' car, and is equipped with soft cushions and arm rests, shades, toilet case, and card rack. It takes the place of the closed carriage formerly in use, only it travels faster and is more stylish.

The study of the technical points, while to those interested is sufficient to attract attention, becomes very useful to and much appreciated by the ladies of the family. The motor car provides an independent line of travel ready at all times. The house-

hold is made complete by the acquisition of a motor car and is a pleasure to all who learn to make use of it.

To drive as a pastime requires a car and the time, and, I should add, the gasoline. If one has a car and drives one is bound to have gasoline and lubricating oil. Driving is a pastime so long as the oil and gasoline are the only essentials, but when it requires repairs and adjustments the romance of motoring ceases, at least until the repair is over. Until then the street cars again look good. There are cars now which to drive is a pleasure and pastime, in as much as there are no repairs necessary, no adjustments required. I think the principal thing to do about a motor car is to do nothing. If the car is not

right when it comes from the dealer it never will be right; thus to do anything is futile. The promises that a motor will work in; that after it has run 5,000 or 10,000 miles everything will be smooth, are subterfuges and put-offs to the day of realization of the first statement, that if the car is not right when it leaves the factory it never will be right. Many drivers have not had any engine phenomenon to diagnose because they were fortunate in having first-class cars. However, if they would have had any, a correct diagnosis would have given a remedy and a cure result. Some cars can only be cured by lengthy repairs. This should not occur to a new car, but may be expected to one run five years or so. If the car is right to start with there

is nothing but natural wear going to operate against it. This one expects.

A thorough test of materials which go into the engine and car, and a proper tempering of them, are in a great measure the elements of manufacture that give lasting satisfaction to the buyer. There is truth in it, and where truth is there is reliability. Pleasure and pastime is derived first by having the car you like, then taking it out for a drive over the hills through the country. It is the same fascination that carries all the toilers of the city out on a picnic in the country. The hills, the sky, the trees, the roads and byways, all waiting for the hour of rest, fragrant with the odor of wild flowers. It is a means of our city people seeing more of

their surrounding lands and suburbs than ever before. The country wayside inns cater comfortably to the auto parties which seek their rural haunts, and chicken-dinners for motorists have become a regular bill of fare with many of the village hotels. Gasoline is everywhere.

There is opposition to motoring. How absurd! It is based upon the general antipathy to that which is improvement and progress. We have at present various kinds of automatic machinery, but the auto is the most conspicuous and therefore attracts the most comment. There is a principle of psychology that the average mind can not appreciate or comprehend anything outside the influencing idea dominating the mind at the time,

and that it is only the superior intellect that can rise out of the dominating and nearby influences and take views of minds not under similar influences. Some can not view outside their own surroundings and limitations. Broader minds are more sympathetic, and can see from another's point of view. If non-motorists would place themselves in the motorist's position, even mentally, some of the misunderstandings regarding motor cars and their care, operation and maintenance would be more generally understood. It is not necessary that a motor car owner be a multimillionaire, nor is he to be expected to be presuming that he is one. It is his interest in motors that has led him to buy one. Why should he be presumed to have

committed a misdemeanor. There is a list compiled by a well-known writer* of men to avoid such as:

Avoid him who vilifies his benefactor.
Avoid him who is honest only for policy's sake, etc.

I will add to this list,

Avoid him who slanders his neighbor for buying a car,
Especially if he afterwards buys one himself.

To maintain a car in proper condition requires more work than money. It requires industry.

Some there are who may not believe this statement, but, believe me, work and industry on your car will do more for the rich appearance which it presents than

*Henry Clews in "Wall Street Point of View."

all the mere money can ever possibly do.

Aside from motor shows, which occupy the automobile people during the winter and the tours and races which take place in the summer time, there is all the independent touring and driving of the automobile owners. A drive through our suburbs shows the growth of the use of the motor. Old stables transformed into garages, also the commercial storage-service garages of our motor-car companies, indicate the extended use of the auto. Gasoline is the motive power of the day.

Autos have brought with them the toggery and style in clothing and motor language, both of which are already widely diffused. Motor clothing is particularly comfortable, and runs all

the way from heavy ulsters of fur for the winter to silkoline dusters for summer. If one goes to New York in January, one of the many reasons may be to see the motor-car show, which is as much a society event as any other event in Gotham. If you were given a ticket to the New York Auto Show, would you go? It depends on how much you are interested in motor cars.

The controversy over the so-called silent so-and-so and the noiseless what-you-call-it is always on. All motor cars are becoming noiseless and silent in their operation, and although the motor is noisy if allowed to exhaust into the air direct, the muffler takes care of the noise and silences it. It is generally the balance of the car and not the

motor that produces the noise. The engine in high is always silent. In second or intermediate there is the noise of the gears, but it is not engine noise. Fine workmanship and design on the gears makes them noiseless. The puf-puf-puf, however, is not by any means as disagreeable as the flip-flop of some carburetor shutter valve. Where the sound is a quiet purr, indicating constant intake and exhaust, but no metallic sound whatever, you have perfection of adjustment as it is today known.

The popularity of the sport is based upon more far-reaching fundamental ideas than fancy. The auto appeals to the economy in transportation, rapidity of travel between different parts of town and home, independence of

street cars, a car line of your own, household conveyance, and carry-all. It appeals to the mechanical interest of the people who love to see machinery in operation. The same interest that takes visitors to the machinery-rooms of pumping stations and electric-light plants attracts minds to the gasoline engine. Those who predict that the auto will fade away must be classed with those who do not believe in progress of any kind, and prefer to let others do what is termed experimenting. There is a contingent who, although they believe the auto is a good and practical thing, are waiting for a later period to buy one. Another contingent wonder where a man gets the price of gasoline, it being so well circulated nowadays that oil is such an expensive article

and such large dividends are paid by the companies that furnish it. The price of gasoline is eleven to sixteen cents per gallon, according to grade. In another chapter I have explained the various grades of gasoline used in motors. Inasmuch as the average car runs eight to twelve miles per gallon of gasoline, you can calculate how much a car will use. There is more utility in ten cents spent in gasoline than the same amount spent in other fluids that are sold in small measures. The cost of automobiling is no hindrance to those who motor, but seems to be an almighty argument for those who do not own one.

The Automobile Blue Book is the most complete guide of American roads ever compiled. All of the United States and Canada has

been traveled and the Blue Books state autometer distance, condition of roads, railroad crossings, fording of rivers, garages, and hotels. While the four volumes sell for five dollars per volume, they contain information that is invaluable. The proverbial "You can't miss it" of the farmers who direct you on your way over the road is obviated by the Blue Book as it has such full information. Together with your autometer you know exactly where you are, as does a mariner who reads the stars with his quadrant and plots the course of his ship on longitude and latitude lines.

The new things in the motor world are generally sprung at the auto shows and afterward get into the supply stores and garages. Motor supplies and accessories

are as interesting as the cars themselves and attract their share of attention. The literature of motoring has been maintained by several journals devoted exclusively to motor-car news, and all magazines and newspapers contain automobile columns.

Public interest centers a great deal in "how long will a tire last?" This is a near relative to the supposed high price of gasoline. Punctures do not occur very often, not near as often as many people would imagine. Two or three punctures a year are about all average running will produce, and these are not generally due to wear of the tire. Tacks and nails are the most ordinary causes for punctures. These are hard to see and consequently impossible

to avoid. After the mileage is up on a tire it is generally old and worn and will need to be replaced. Punctures are repaired for fifty cents, and casings last two, three and four years, according to wear. Tires last a long time and do good service. Four to five-inch tires are generally used.

The number of prominent people who have become interested in motoring demonstrates the drawing interest in the motor car and shows the good qualities it appeals to. The motor car appeals to intelligence — not to mere wealth.

Although the number of motors running has greatly increased in the past few years there are numerous people, even at the present time, who have not learned the valuable accomplishment of auto-driving. Those who are anxious

to know will appreciate the foregoing monograph of the subject in its present simplified form.

Some people still cling to the idea that the auto is a joy-ride vehicle, but this old-fashioned notion is gradually subsiding, and the use of the motor to such quasi-delectable ends in practiced only by a character of people we need not mention.

Our citizens are more and more every year showing their interest in this modern method of locomotion and attest same by investment in some one or other of the various makes of motor cars on the market. Even those who have strenuously opposed the purchase of a car afterward come out with one. In fact, the avowed opposition to the motor is, very often, a

stage, or degree, of being won to its favor.

The story goes that a certain chauffeur left his car in front of a store with the engine running, and when he came out he found the car moving away. He discovered that the mechanism had started with the engine and the car had moved away all by itself. Such yarns as these both repel and attract the public; repel, in that they upset confidence in the motor; attract, in that further inquiry into the mechanism of the car develops an interesting study of what curiosity alone was the first attraction. This study of the motor car makes for better understanding of the vast amount of work that has been accomplished in this field of endeavor. That a car move away by itself is as true

as that a carriage could hitch up the horse and drive away. There is nothing as yet that is to an auto what a pianola is to a piano. There is no automatic driving machine or automaton. However, driving is so simple that without all the theoretical knowledge of the mechanism of a car, one can accomplish a great deal, much as one, with the pianola intervened, accomplishes with a piano. Foolproof means brains supplied. This is found in the modern motor, although a certain amount of gray matter will be found necessary to operate the stops and levers.

As said elsewhere in these pages, giving the manufacturers due credit for the amount of brains supplied with the car, the more accomplished the driver, the

more educated his understanding of the principles of the motor car, the better and finer are the results obtained in driving.

This article is by no means to be considered a "probe" of the subject, but merely a brochure, thesis, or monograph, of a few of the many interesting phases of "Modern Motoring."

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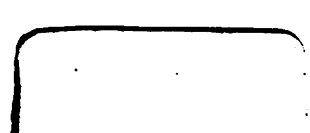

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